Space Weather Technical Forecast

Issued on Monday, 30 May 2022 at 01:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low. There are three sunspots on the visible disc, two are simple, benign alpha regions. A newly emerged sunspot AR3025 in the northwest quadrant has undergone development and is now a bipolar group with a Beta/Bxi configuration. No Earth directed CMEs have been observed in coronagraph imagery in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR and ACE at L1, initially varied between 480-520km/s with influence from coronal hole 85. An increase to 530-560km/s was observed from around 29/0830 UTC, this likely due to the onset of the high speed stream from coronal hole 84. Density as mainly been at average levels, but with a brief increase to above average levels with the interpreted arrival of the CIR of coronal hole 84, peaking at just over 12ppcc at 29/0843 UTC. Total magnetic field strength, Bt, has been largely weak, with the north-south component, Bz mainly in a southward direction and generally only short-lived interludes into a positive direction. The Phi angle has been predominantly negative (towards the Sun). Geomagnetic activity was mainly Quiet to Unsettled, but increased to Active between 29/1500-1800 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels throughout the past 24 hours. The high energy electron flux (greater than 2 MeV) was at background levels initially, but increased to moderate levels from around 29/1300 UTC with a peak observed flux of 888 pfu at 29/1910 UTC. Corresponding electron fluence has followed a rising trend during the second half of the UTC day and was at 1.94e7 integrated pfu observed at 30/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low or Very Low, but with a slight chance of M-class flares. This is mainly due to AR3017, over the western limb, or new sunspot regions that are expected to rotate over the eastern limb in the coming days.

Solar Wind / Geomagnetic Activity: There is a chance of a glancing blow from a CME on day 3 (1st June). Earth is currently in a high speed solar wind environment from a coronal hole with elevated solar winds. As the influence of the coronal hole wanes, wind speeds should ease to slightly elevated or perhaps background levels by the end of day 4 (2nd June). Geomagnetic activity is expected to be mainly Quiet to Unsettled on day 1 (30th) with a slight chance of Active intervals and a very slight chance of G1/Minor Storms. Mainly Quiet conditions are then likely with a very slight chance of Active or G1/Minor Storms on day 3 due to the possible CME arrival.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at Background levels during this period. High energy electron flux (greater than 2MeV) is expected to be at moderate levels initially, likely increasing to high for a time on day 1 or 2 (30th/31st May) before easing to moderate or background levels again by day 4 (2nd June). Electron fluence is forecast to follow a rising trend, but is not currently expected to reach the Active (1e8 integrated pfu) threshold.

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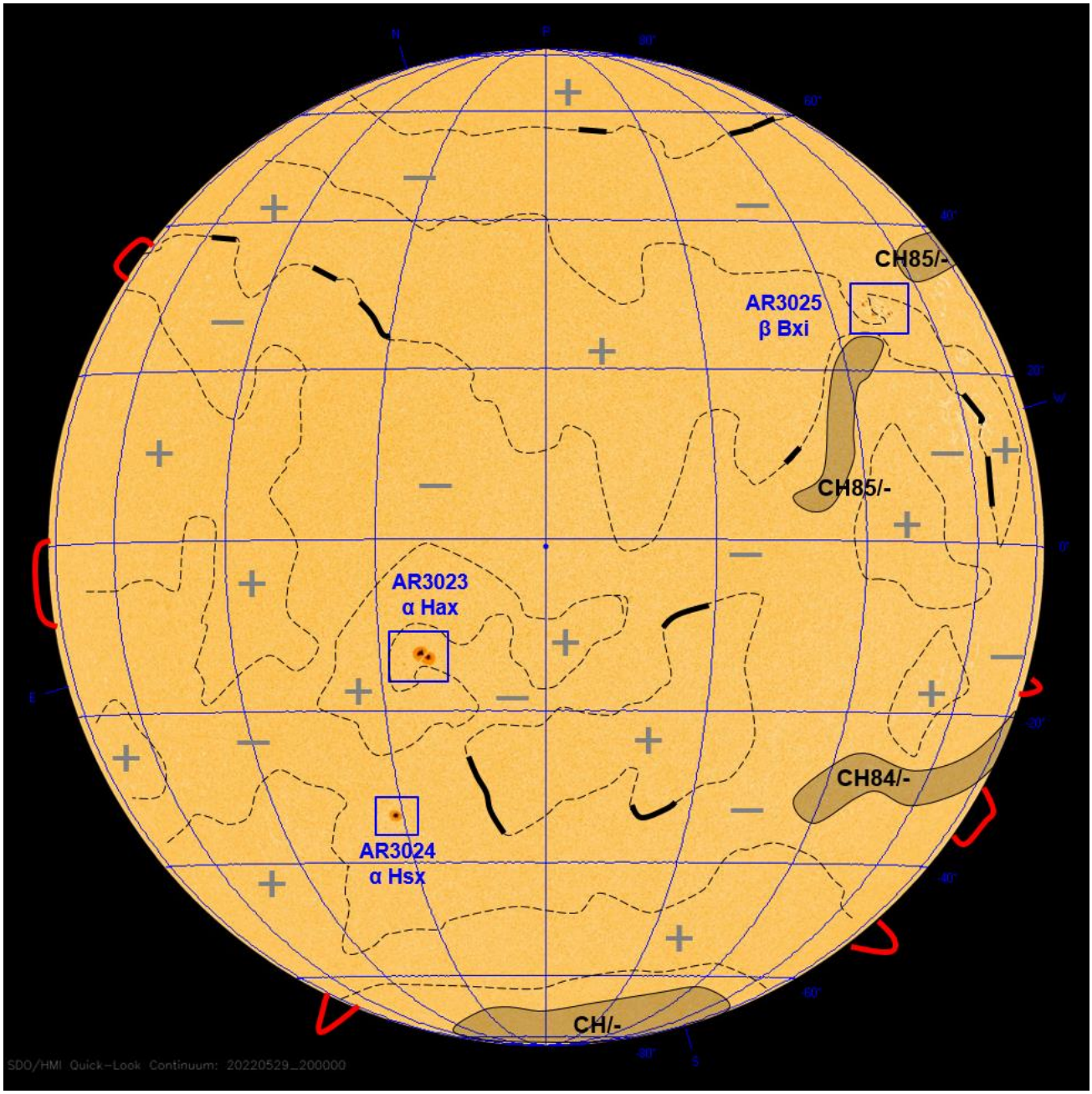
Figure 1. Solar Analysis Valid 29/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME from 28th May has been analysed and is due to pass to the south of the Earth, but there is a chance it could give a glancing blow on day 3 (1st June).

Earth is currently in the high speed stream from coronal hole 84 with elevated solar winds. As the influence of the coronal hole wanes, wind speeds should ease to slightly elevated or perhaps background levels by the end of day 4 (2nd June).

Geomagnetic activity is expected to be mainly Quiet to Unsettled on day 1 (30th) with a slight chance of Active intervals and a very slight chance of G1/Minor Storms. Mainly Quiet conditions are then likely with a very slight chance of Active or G1/Minor Storms on day 3 due to the possible CME arrival.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – None expected

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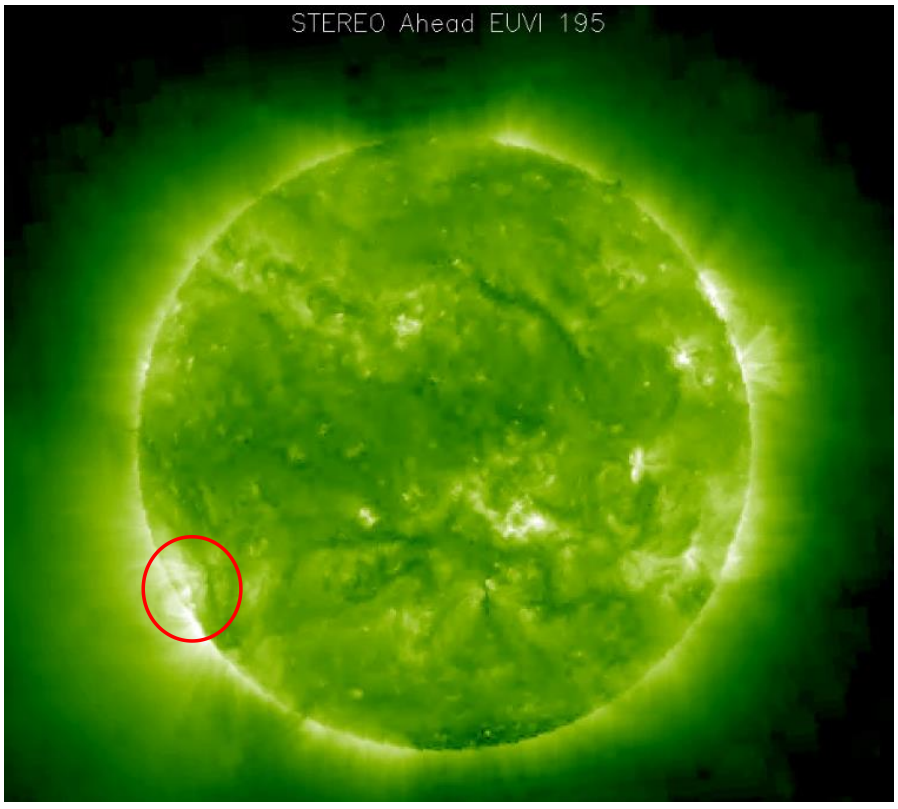
Radio Blackouts - X-Ray Flares:

Solar activity is expected to be mainly Low or Very Low over the next four days, with three small, generally simple sunspots on the visible disc at present. The slightly elevated risk of M-class flaring on day 1 (30th May) is due to the risk from AR3017, a historically active sunspot, which could still produce observable flares from beyond the western limb.

STEREO EUVI imagery is observing a number of bright regions beyond the eastern limb in the southern hemisphere. These are expected to rotate onto the visible disc from day 2 (31st May) onwards. As a result, slightly enhanced M-class flare probabilities are included.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: STEREO-A EUVI imagery at 29/2325 UTC. Circled region with bright flux suggesting new active region(s) to rotate over the eastern limb in the coming days.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is most likely to remain so through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is currently at moderate levels, with the observed rise likely due to the decompression of the radiation belts following from the influence of coronal hole 85. The onset of coronal hole 84 may suppress electron counts for a time on day 1 (30th May) but could rise again later, more especially on day 2 and 3 (31st May and 1st June) with further decompression of the radiation belts likely bringing high electron flux later in the period.

Electron fluence is likely to remain below the Active (1e8 integrated pfu) threshold during the period, with a slight chance of reaching Active levels on day 1 and 4, and a chance on day 2 and 3. Current MOSWOC REFM models is suggesting an increase on day 1 and 2, followed by a steady decline, likely due to an absence of longer-lived elevated winds in the REFM model. Persistence (Recurrence) shows a similar trend, but has too elevated starting fluence compared to observed values.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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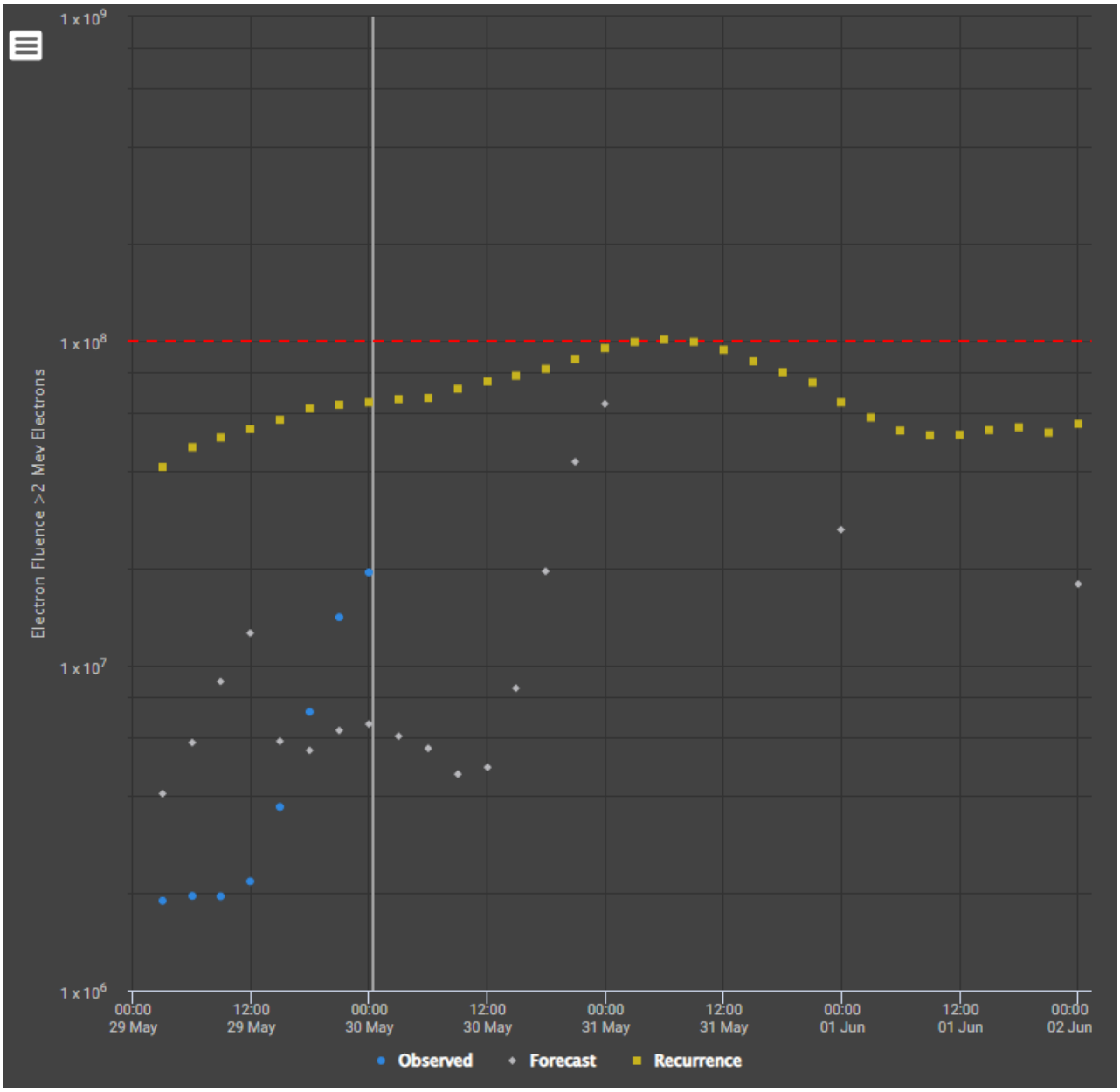
Figure 3: MOSWOC REFM model output and observed fluence values



NOTE: Our REFM model has been upgraded and has changed in appearance. The two main changes are the option to include a recurrence graph, which traces what happened on during last solar rotation for comparison and potential expectation in the coming 3 days (each plot is the observation from T-minus 28 days). Also, the cadence of REFM forecast fluence data is reduced past day 1 to only one value per day. The cadence remains 3-hourly for the first 24 hours.

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